CONTRAST-ECHO: A COMPARISON OF COLOR DOPPLER, CONTRAST ECHO AND ENHANCED COLOR DOPPLER IN THE DETECTION OF CARDIAC SHUNTS IN ADULTS

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Purpose of the study was to compare individually the diagnostic validity of color Doppler (CD), conventional contrast echo (CE) and contrast enhanced color Doppler (ECD) in the detection of ventricular and atrial septum defects (VSD/ASD) using the transthoracic approach. Methods: 42 pts with known septum defects (14 VSD, 28 ASD, age 15-77, mean 38 yrs) were examined in standard and atypical planes. The contrast agent was SHU 454 (Echovist, Schering AG) in 26 pts and oxypolygelantine/saline solution in 16 pts (minimum of 5 injections of 4-10 ml of each). Native CD studies and CE studies were performed according to routine procedure, but ECD was carried out with a reduced gain level in order to avoid artefacts due to supersaturation after contrast injection. Results: VSD: CD showed signs of transseptal flow in 12/14 pts, with a clear outline of transseptal flow in only 10 pts, whereas ECD clearly demonstrated delineation and localization of VSD in 13/14 pts. ASD: In only 9/28 pts was delineated transseptal flow identifiable with CD, whereas in ECD, this was possible in 26/28 pts. Using CE, definite shunt detection (identified by contrast effects in the left heart) was possible in VSD in 9/14 pts and in ASD in 21/28 pts.
Conclusion: The use of echo contrast agents leads to a remarkable improvement in the visualization of transseptal flow and thus improves the accuracy of cardiac shunt detection and diagnosis.

AN IN VITRO MODEL FOR THE ASSESSMENT OF MITRAL VALVE AREA USING CONTRAST ECHOCARDIOGRAPHY.

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Contrast echocardiography is capable of measuring volumetric flow. Therefore, it was hypothesized that it would be possible to accurately assess mitral valve area using contrast echo, and an in vitro model was developed to test this hypothesis. Interchangeable 40 ml "atrial" chambers (valve orifices of 0.5, 1.0 and 1.5 cm^2) were connected to a 125 ml "ventricular" chamber. The atrium was primed with a microbubble contrast agent, and saline was injected into the atrium using a power injector during 2-D echo imaging from the apex. The area, length, width at the base (D1) and width at the leading edge (D2) of the contrast jet were measured 0.13s after injection and compared.

Atrial parameters		Contrast jet parameters (cm or cm^2)			
Orifice	Diameter	D1	D2	Length	L/D2
0.5cm^2	0.79cm	0.7±0.1	2.2±0.5	4.6±0.9	2.1±0.5
1.0cm^2	1.12cm	1.0±0.2	2.6±0.5	2.8±0.8	1.1±0.4
1.5cm^2	1.38cm	1.6±0.3	3.6±0.7	2.1±0.6	0.6±0.2
Anova p value		0.0001	0.007	0.0001	0.0001

The smaller orifices had longer, narrower jets. It was possible to estimate the size of the orifice by D1. Linear regression analysis of jet area/frame versus actual flow delivered by the power injector correlated well for all orfices. However the mean slope of the regression line was near unity (0.98) only for the 1.5cm^2 orifice, with smaller orifices tending to overestimate flow (slopes of 1.8 for 0.5cm^2 and 1.5 for 1.0 cm^2).
Conclusion: It is possible to assess orifice area using contrast echocardiography in an in vitro model. Jet geometry and width can provide an estimate of valve area. Area measurements overestimate flow with smaller orifices probably due to turbulence-induced mixing. It may be possible to assess mitral valve area in mitral stenosis using transpulmonary contrast echocardiography in humans.

THE UNRELIABILITY OF MYOCARDIAL CONTRAST TWO-DIMENSIONAL ECHOCARDIOGRAPHY IN ASSESSING THE TRANSMURAL DISTRIBUTION OF BLOOD FLOW.

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There is controversy regarding the ability of myocardial contrast two-dimensional echocardiography (MCE) to determine the endocardial/epicardial blood flow ratios (EER). A study using larger microbubbles (15-25μ) suggested that the EER can be measured in humans using MCE. Another study using smaller microbubbles (4-5μ) suggested that it is not possible to do so. Furthermore, it is not clear whether the results are similar from the anterior versus posterior myocardial beds. In order to resolve these issues, we performed MCE in 6 open-chest anesthetized dogs. Hydraulic occluders were placed on both the left anterior descending (LAD) and left circumflex (LC) arteries. EER was determined using radiolabeled microspheres. Data were collected at baseline and during LAD and LC stenosis (gradient ≥ 40mmHg). MCE was performed using both small (Albunex®, size < 5μ) and large (hand-agitated renografin-saline) microbubbles at each stage of the experiment. Area under the curves (AC) and peak intensity (PI) were derived from computer generated time-intensity plots. The EER in the LAD bed varied from 0.31 to 1.70. The correlation between EER and MCE derived parameters from the LAD (anterior) bed were poor for both small and large microbubbles (r = 0.19 and 0.40 for AC and r = 0.07 and 0.46 for PI, respectively). The EER in the LC bed varied from 0.13 to 1.21. The correlation with MCE derived parameters from the LC (posterior) bed varied between small and large microbubbles (r = 0.90 and -0.49 for AC and r = 0.93 and -0.37 for PI, respectively).
We conclude that although MCE can assess mean transmural blood flow accurately using small microbubbles, it is unreliable in determining the transmural distribution of blood flow using small or large microbubbles.

RETROGRADE CORONARY VENOUS MYOCARDIAL CONTRAST ECHOCARDIOGRAPHY IN HUMANS: CAN CORONARY VENOUS RETROINFUSION DELIVER PHARMACOLOGIC AGENTS TO THE MYOCARDIUM?

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To verify that coronary venous retroinfusion reaches affected myocardium even when the coronary arteries are obstructed and to determine the effective coronary venous pressure (CVP) delivering agents, myocardial perfusion was visualized by retrograde coronary venous myocardial contrast echocardiography (RCE) in 8 patients during angioplasty of the left anterior descending artery (LAD). While RCE was performed by retroinfusion into the great cardiac vein (GCV) of 10ml agitated contrast agents with hazardously high (81±15mmHg) and low (43±10mmHg) CVP, long axis images of the LV were recorded and digitized off-line into a 512x512 pixel matrix. Myocardial perfusions were evaluated by the enhanced gray level after retroinfusion into GCV and antegrade injection into LAD. There were no adverse effects during retroinfusion. Retroinfusion resulted in confluent and transmural opacification. Enhanced gray levels were:

Gray level	control	low CVP	high CVP	antegrade
	3±2	12±5*	20±6**	26±5**

(*:P<0.05,**:P<0.01 vs control)
In conclusion, coronary venous retroinfusion can deliver phamacologic agents, but more effective myocardial perfusion by retroinfusion into the ischemic region requires a hazardously high coronary venous pressure.